Using Process Mapping Software to re-design a Management System

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Abstract

Management Systems are becoming *de rigueur* for Organisations, but many with existing Management Systems are finding that they are creaking at the seams. Changes to Standards, Regulations, Business Practices, Organisation structures and Products mean that Organisations have be flexible and their Management Systems also. With Management Systems based on those written in the 1990s, companies are realising that they need to make a step change in order to maintain their competitive advantage.

This Management Summary will discuss why Process Mapping should be considered as a method for this improvement, what to consider when choosing a Process Mapping tool and how the change should be planned. It uses experience from several companies with which the author has been involved.

Keywords: Process Mapping, Management System, Quality

1.0 Introduction

Management Systems need to be continually reviewed to ensure that they keep in step with the changing Standards and Regulations. These may include Statutory requirements (for all countries in which a Company trades), Corporate rules (for those Organisations that are part of larger bodies), Industry-specific regulations (relating to the Industry they are in and the type of Customer they have) and Quality Standards (often required by the Customer). For all of these, Organisations have to demonstrate compliance.

2.0 Why a Re-design might be needed

Many Management Systems will have been written against earlier versions of the Standards and then reviewed and updated at each new version. This can result in a mixture of procedures where new practices have been added without wholly removing the old ones.

Business Practices are changing. Companies are now looking at their Supply Chains to gain competitive advantage and to ensure that only genuine parts are incorporated into products. This means that there is pressure on Suppliers to improve their Management Systems, so that they can provide this traceability and so on down the Chain.

Companies may add to their portfolio of project and product types and need to update their Management Systems to cover additional compliance. Project and product types may be removed from the types of work undertaken and the Management System reviewed to remove unnecessary procedures.

Organisations change. Small companies with their own certified Management Systems and acquired by larger companies, may be subsumed into the larger company's Management Systems. Large Companies which buy these smaller enterprises may need to adjust their Management Systems to include new products and services resulting from these acquisitions. Companies may divest themselves of parts of their business creating a new business in its own right and both parties then need to review their Management Systems. It is likely that the new company was covered by the Certifications of the parent, so will need to create their own Management System, though taking a copy and merely changing the company name will generally not be appropriate.

Staff move on. The people who originally wrote and approved the procedures may have left the company or moved into new jobs. Senior Management may have changed due to acquisition or divestment. There may be no-one now who understands the Management System in its entirety, so changes can have unexpected knock-on effects.

Internal audit and external assessment sometimes find flaws in the Management System where changes to working practices have not kept pace with the changes to the Management System or vice versa. This can mean that new procedures are added to the Management System to satisfy these findings without considering the effect of these new procedures.

Technology is always evolving. At one time, the Management System would be a single, typed document held by the Quality Manager. Now in tech-savvy companies, the Management System is available on the Company Intranet which can include hyperlinks from document to document.

3.0 What are Process Maps?

A process map is a diagram showing what the process is and can be used to minimise written procedures. There are several well-known notations, which are available in many tools, though some software tools offer their own notation.

3.1 Flowcharts

The use of pictures and diagrams has a long history. One of the earliest forms was the Process Chart which was introduced in the 1920s by Frank and Lillian Gilbreth [1], to document process flow. Through its use in Software Programming, the idea evolved into the Flowchart. While there are many symbols available [1], a simplified form is generally used for showing the flow of control. The flow is shown as a series of rectangular boxes containing the process steps, with diamond shaped boxes for questions with Yes/No answers to define the flow (see Figure 1).

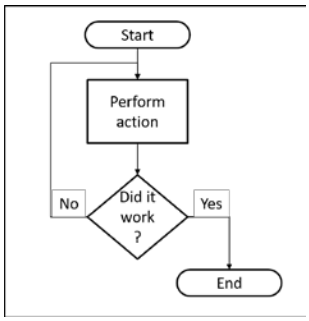

Figure 1: Flowchart

3.2 Integrated Computer Aided Manufacturing (ICAM) DEFinition for function modeling (IDEF0)

In the 1970s, the IDEF0 Notation [3] was developed by the US Air Force Program for Integrated Computer Aided Manufacturing (ICAM) as a function model to represent the functions, activities or processes within the modelled system. It includes the Inputs, Outputs, Controls and Resources required (see Figure 2).

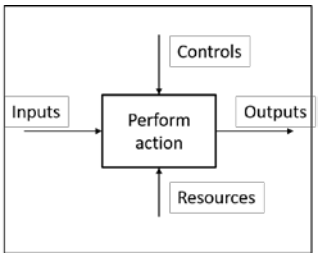

Figure 2: IDEF0 Top-Level Context Diagram

IDEF0 also introduced the concept of decomposition, where a single process step could be shown in another map broken down into its lower-level process steps. Each of the outputs of the intermediate process steps form the inputs of another (see Figure 3).

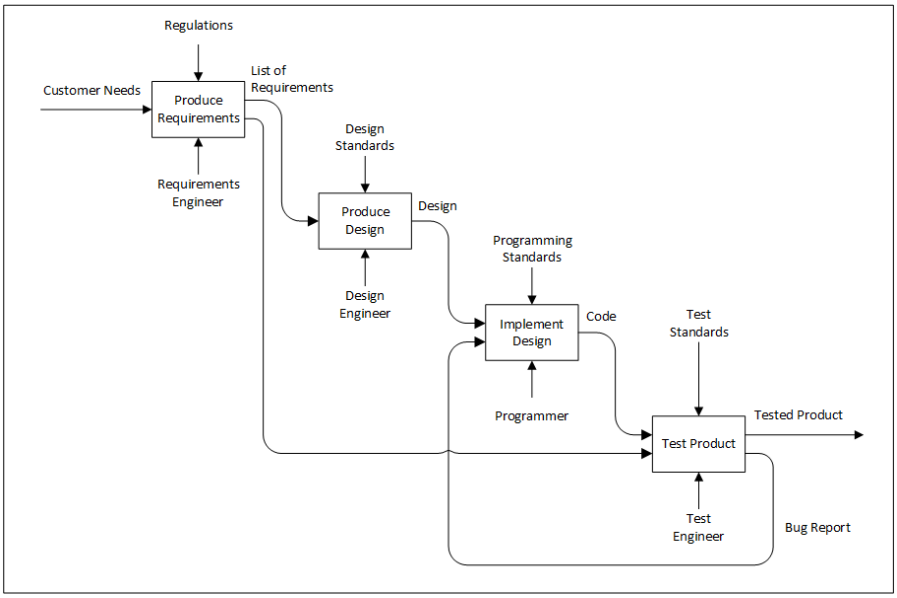

Figure 3: IDEF0 Diagram Example

3.3 Business Process Model and Notification (BPMN)

BPMN [4] was first released in 2004 and provides a graphical notation that can be used to define an Organisation's processes. Like the flowchart, this has Activity boxes and Gateway diamonds for decisions and has Event circles to show the beginning and end of the process. It also has the capability of including data objects like Data Stores and differentiating the different types of flow, e.g. sequential flow and message flows (see Figure 4).

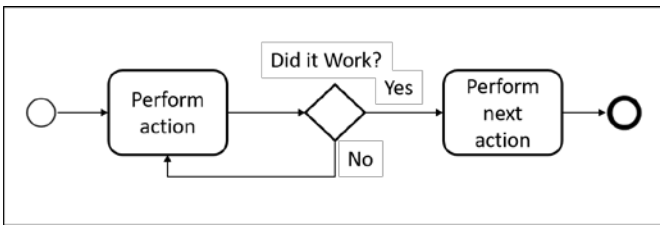

Figure 4: BPMN Diagram

3.4 Process Navigator

Process Navigator from Triaster [5] is a software tool with its own notation. Its process maps include Activities connected by deliverables (artefacts) that are used by or produced by the activities. All maps begin and end with deliverables i.e. an activity is always triggered by a deliverable and will always produce at least one deliverable. These may be tangible items like documents or products or could be intangible like 'Monthly' (triggering a monthly activity) or 'New Employee added to the Payroll'. Process Navigator also differentiates between external deliverables, that come from or go outside the company, and internal deliverables which must be created and used at least once in the complete set of maps. Since the start and end internal deliverables must exist in more than one map, they are used to link the process maps together. Decision boxes are diamond shaped, but are treated as activities and have at least two deliverables as outputs though they could be a range of values as shown in Figure 5. Responsibilities can be added below the activities and decisions. Any activity or decision can be drilled-down to another process map, which shows the detailed process steps of that activity.

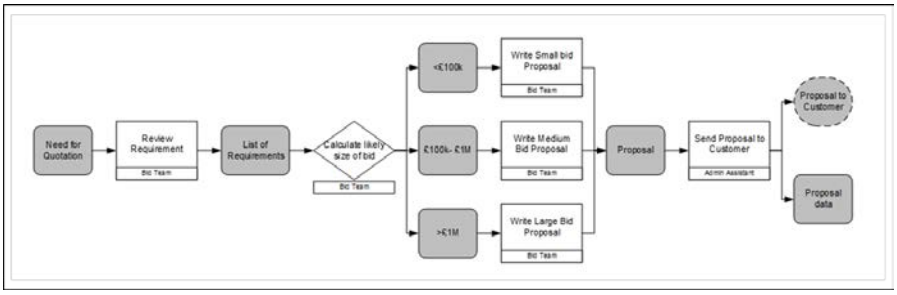

Figure 5: Process Navigator Process Map Example

4.0 Why use Process Maps?

Process Maps can satisfy the needs of the different groups of people who need access to or who provide the information for the Management System.

4.1 For the Users

Process maps allow the process to be seen at-a-glance. All the notations mentioned use boxes to state the process step or activity in about seven words. This means it is easy to scan the map to gain a high-level understanding of the process or to understand what needs to be done. This can reduce the amount of training required for new starters and for people changing jobs.

A Software tool can provide access to the other documentation and applications associated with the map using hyperlinks and is likely to be accessible on phones and tablets as well as Personal Computers (PCs).

4.2 For the Process Owners

The maps clarify the process and allow the responsibility and accountability for the activities to be defined. This can reduce the likelihood of mistakes being made.

4.3 For Internal Auditors and External Assessors

With the emphasis in ISO 9001 (Quality Management Systems - Requirements) [6] and AS9100 (Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations) [7] for the auditing of processes, the process maps make it easier to understand what the process is and what records should be available.

Where Regulatory Compliance, e.g. Aerospace, Medical, Legal or Safety-Critical, is required, the maps can be used to show the appropriate part of the processes.

5.0 Re-designing the Management System

5.1 Initial Planning

Planning for the change from written procedure-based to process map-based Management Systems needs to be considered carefully. It is a major change and must have the buy-in and on-going support of the Senior Management as while a lot of the work will be done by the Quality Department (or equivalent), Senior staff and Subject Matter Experts from the other Departments will need to be involved. It should also be noted that this is the stage at which Quality Management Systems (primarily used to assure Quality Product) can metamorphose into Business Management Systems covering everyone in the Organisation and making everyone a stakeholder in assuring Product Quality Repeatability.

The initial approach to the Senior Management may be a presentation. It should describe the problems that the current Management System is having and how a new Management System supported by Process Maps will overcome these problems and help the Company to improve. It should also include the qualitative and quantitative benefits to the business of the new system.

The result of the meeting should be an agreement to proceed to the Business Case, probably with a budget limit.

5.2 Choosing the Process Mapping Software

5.2.1 Are there any Corporate Requirements to be considered?

If the Organisation is part of a larger company, the Corporate Systems current or planned have to be considered to ensure that there is no conflict. Large American companies usually have Corporate agreements with American Software vendors and expect all their subsidiaries to comply, sometimes regardless of whether the tool fits with the needs of those subsidiaries. Introducing a new type of tool, e.g. process mapping software, may appear to conflict if they have not understood its purpose.

5.2.2 Can the current Information Technology (IT) Infrastructure support the Tool and any additional software it needs?

The software tool may require a specific infrastructure, for example, a high specification server running Windows or Linux. This may already be available in the Organisation, but if not then the cost of the additional hardware should be a factor in the choice of tool. In addition to the Operating System there may be additional tools that are required. For browser-based applications, there will need to be a webserver and the mapping may require a tool like Microsoft Visio.

5.2.3 Can the Tool support interfaces with other Business Applications?

Many companies already use Enterprise Report Planning (ERP)/Material Requirements Planning (MRP) software systems to support their businesses. It would be useful if the tool could provide direct access into these Systems, e.g. hyperlinks from the maps into appropriate transactions.

5.2.4 What should the Process Maps look like?

Notations like Flowcharts (see section 3.1), IDEF0 (see section 3.2) and BPMN (see section 3.3) appear very technical and might not be easy to understand by everyone. Alternatively, if those notations are required, choose a tool that could convert the model into a more readable form.

If colour is to be used, especially to differentiate between different types of similar shapes, then the effect of colour-blindness [8] should be taken into account.

5.2.5 How will the Process Maps be provided to the Users?

If all staff have access to PCs which are always linked to the server, then a client-server application or browser-based application would be sufficient. If some staff will be using phones or tablets a mobile version of the Management System will be needed. If there are off-site workers who work without access to the server, they will need to have a variant that is standalone.

Accessibility [9] should also be a consideration and include the impact of both visual impairment and physical ability to use the Management System.

5.2.6 How easy is it to create the Process Maps?

The ease of use may affect the amount of resource required and the time taken to complete the mapping. The easier the maps are to create, the larger the pool of potential resources. With more resources able to map, the timescale could be reduced, but this may be balanced by the cost of the resources and the time lost to their usual work. If more skill is required, then fewer resources may be available and the timescale could be longer.

5.2.7 Can associated documentation be accessible from the Process Maps?

While the procedures may have been replaced by the process maps, it is likely that there will still be a need for Work Instructions and Forms and they should be accessible from the appropriate map. Consider also how the high-level Policy

documents like the Business Management Manual (formerly the Quality Manual) will be accessed. It may also be possible to add links to other company applications like SAP and Oracle.

5.2.8 Is there a defined methodology for creating the Process Maps?

The traditional method of mapping processes is to define the top level and then decompose the activities until the lowest level is reached. However, depending upon the complexity of the top level, there may be a varying number of levels across the map set.

The alternative method is to build from the bottom-up. These means that all the 'working' level maps are at the same level and could be linked horizontally. The higher level maps can be used to display summaries of the lower-level processes.

5.2.9 Can the Tool provide additional information about the activities?

The Responsibility, Accountability, Consulted and Information (RACI) model can provide the roles and their responsibilities in the processes. Given the visual nature of the process maps, it would be useful if this information could be recorded for each activity. Other information could be the Standard and Regulation clauses to which the activity provides compliance coverage.

5.2.10 What Reports and Metrics are available?

The tool is likely to provide a number of standard reports, but consider whether other reports are required and the ease (or cost) of creating them. If Standard or Regulatory compliance is required, then producing a report from the processes showing the compliance coverage will be useful for External Assessments.

The data from the Software Tool system should also include metrics on the usage of the Management System, for example, the number of people visiting the maps and the frequency of changes to them. It is likely that there will many visitors initially, but trailing off as they become familiar with the maps. There will also be a number of changes at the start, reducing as the maps become more mature. If the usage figures and the number of changes drop below a threshold, the Management System may be failing in its purpose.

5.2.11 Can the Tool provide a history of the changes to the Process Maps?

After the initial introduction of the new Management System, changes will be required. It would useful if the tool could record these changes together with a copy of each version of the maps. It may be necessary to revert to a previous version or to see the system as it was at a specific point in time.

5.2.12 Is there some form of automated approval?

As the changes are requested, there needs to be some form of approval that the change can be incorporated into the Management System to ensure the content is correct and that the compliance coverage is maintained.

5.2.13 What is the software licensing model and the cost?

If the tool is Open Source, check that this use of the tool does not break the terms of the licence, e.g. the GNU General Public License (GPL) [10].

If the tool is commercial, the licensing model needs to be considered. The software is sometimes provided "forever", with upgrades paid for under the Support Contract or it may be a subscription model and the software is available while the subscription is being paid, after which it will cease to work.

There may be additional costs for setting up the system, for training of the mappers, customisation of the interfaces, e.g. to include the Company logo, and general consultancy.

The support and maintenance contract should include periodic upgrades, troubleshooting problems by email or phone and the facility to request improvements.

It should be noted that with large vendors most of these services would be provided by local consultants with the support run by the vendors themselves. This may mean that if any bugs are identified, there may not be a fix until the next upgrade cycle. Smaller software vendors may provide the consultants themselves and provide fixes to the bugs quite quickly.

5.2.14 Does anyone have experience of Process Mapping Tools?

Actual experience, good or bad, of using the tools or of the vendors is always valuable. Consider, though, how long ago they used it - bug fixes and additional functionality in the intervening years can improve a bad tool.

5.3 Writing the Business Case

The Business Case or Proposal builds on the information provided in the initial presentation but will also include the Approach, the level of Resources, the draft Schedule and the estimated Cost. At this stage, the re-design may be considered as a project.

5.3.1 Approach

The Approach includes whether the re-design is to be provided as a Big Bang or Phased, for example, by department. With the Big Bang approach, everyone's processes will suddenly change which could be bewildering to the users, whereas with the Phased approach users will become more familiar with the system as they interface with those other departments already mapped. On the other hand, as departments are mapped their processes may affect those of departments already completed and changes have to be made to the latter.

As well as Big Bang versus Phased, the process by which the maps are to be created needs to be defined. Two alternatives are to have a small team of mappers who visit each of the departments, facilitating the capture of the process and

creating the maps or to have mapping teams within each department who capture their own processes and create the maps.

The Approach also need to state how the existing Quality Management System is to be phased out. With Big Bang, it will be here today and gone tomorrow, but with the Phased approach, the two systems will be running in parallel. There needs to be consideration of the effect this will have on the users, on internal auditors and external assessors and on project documentation referencing the old procedures.

The Approach should describe how the project is to be managed. Companies which are used to short projects may use their existing processes; other Companies may be required to use the Corporate procedures intended for multi-million pound projects, adjusted accordingly; small companies may assign a part-time project manager leaving the rest of the team to do the work.

5.3.2 Resources

The resources required for this project will need to include people to map the processes (as defined in the Approach), to provide the additional documentation, to review and approve the maps, experts to confirm that the Standards and Regulatory compliance can be met, librarians to ensure that the rules for the maps and the documentation have been met, IT specialists to maintain the technology and Managers to manage the team. They will all need to be trained to some level.

In addition, once the Management System has been finally released, there will be less to do and the size of the team can be reduced.

5.3.3 Schedule

Whether the final release is Big Bang or Phased, the mapping will have to proceed in stages, the easiest way being by Department. The order in which they would be done will need to be considered. Production schedules should be consulted to avoid taking people from their work to map just when they are needed for a production run. It is also probably not a good idea for the new Management System to be unveiled just before a Standards or Regulatory Compliance assessment.

For the Business Case, a full project plan may not be needed, a simple time-line with milestones may be sufficient.

5.3.4 Costs

The calculations on the cost of the software tool will have been obtained as part of choosing the software. The Resource costs will be related to the Approach and to the availability of staff. The IT Infrastructure cost will be related to any additional hardware, the additional software tools needed and all their associated maintenance costs. Some of this may be covered by Capital expenditure.

The costs for the Business Case may also need to include those for the long-term maintenance, e.g. the Software Tool licence and the Core Team.

5.4 Detailed Planning

Finally, once the go-ahead has been given, the detailed planning can take place.

5.4.1 Resources

While the Business Case stated what type and the number of resources required, it is now time to put in the names of the individuals, at least for the Core Team and to decide the method for obtaining the names of those in the departments who will be involved in the mapping process.

A decision will be needed on who will need training and to what level. Ultimately all the users will need to be trained to use the new Management System and this will also need to be included in the Induction process for new staff or those moving between departments.

5.4.2 Consistency

With the number of people involved in the mapping and creating the documentation, there needs to be consistency for both the look and feel and for the content. It is important that users feel that one person has written everything. This could include providing templates for the documents and forms with guidance for their completion, how the maps and documents are to be numbered and issued, the design rules for the process maps, how the responsibilities are to be described and what data is to be added to the maps to supply the reports.

This could be included in a Policy document with perhaps a guidance document to state how the rules are to be applied.

5.4.3 Schedule

The time-line or draft Schedule from the Business Case now needs to be converted into a Project Schedule. This will provide the Departments with dates for when they will need to release their staff and kept up-to-date on a regular basis.

The timescales for the acquisition and installation of the IT Infrastructure also need to be included as most of the work will be dependent upon this and if there are any complications, the delay can then be conveyed to the Departments. The training may also be a dependency on the IT Infrastructure if the training is to be done on the Software tool.

5.4.4 Communications

A Communication Plan will be required. It should include announcing the start of the project to all staff. Then, as each department is started, all their staff should be informed about what is to be done and how they are likely to be involved. When their section is completed, they will be trained to use it.

There should also be a Progress Report to all staff, either on a regular basis, e.g. in a Weekly Newsletter, or as each Department is completed.

Finally when the Management System is complete, there will be a presentation to all the staff.

6.0 Next Step

This paper has described how Process Mapping Software should be chosen and the re-design planned. The next step is to start the project and to discover what Lessons can be learnt for the Planning.

7.0 References

1 Frank Bunker Gilbreth, Lillian Moller Gilbreth (1921). Process Charts (https://engineering.purdue.edu/IE/GilbrethLibrary/gilbrethproject/processcharts.pdf). American Society of Mechanical Engineers

2 ISO 5807:1985 Information processing — Documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts. Retrieved 11th March 2017 from International Organization for Standardization: https://www.iso.org/standard/11955.html

3 IDEF0 Function Modeling Method. Retrieved 8th March 2017, from IDEF: http://www.idef.com/idefo-function_modeling_method/

4 Introduction to BPMN. Retrieved 11th March 2017, from Object Management Group: www.omg.org/news/meetings/workshops/soa-bpm-mda-2006/00-T4_White.pdf

5 Successful Process Mapping. Retrieved 25th February 2017, from Triaster: http://info.triaster.co.uk/white-paper-process-mapping-report

6 ISO 9001. Retrieved 25th February 2017, from International Organization for Standardization: http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm

7 AS9100D. Retrieved 25th February 2017 from SAE International: http://standards.sae.org/as9100d/

8 Colour Blindness Simulator. Retrieved 25th February 2017, from Etre: http://www.etre.com/tools/colourblindsimulator/

9 Web Content Accessibility Guidelines. Retrieved 25th February 2017, from W3C: https://www.w3.org/TR/2008/REC-WCAG20-20081211/

10 GNU General Public License Versions. Retrieved 25th February 2017, from Open Source Initiative: https://opensource.org/licenses/gpl-license